Dimensions of Complexity

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Acknowledgements

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- I'm merely the editor.

- For contributors, see http://networkcomplexity.org

Summary

- Each network has N design criteria / metrics

  Explicit: Cost, bandwidth, delay, ...

  Implicit: Extensibility, de-bug-ability, ...

- We see those criteria are axes in an N-dimensional graph

  Each network can be mapped into this space

- There are tradeoffs: You can't optimise all axes

Tradeoffs and Complexity
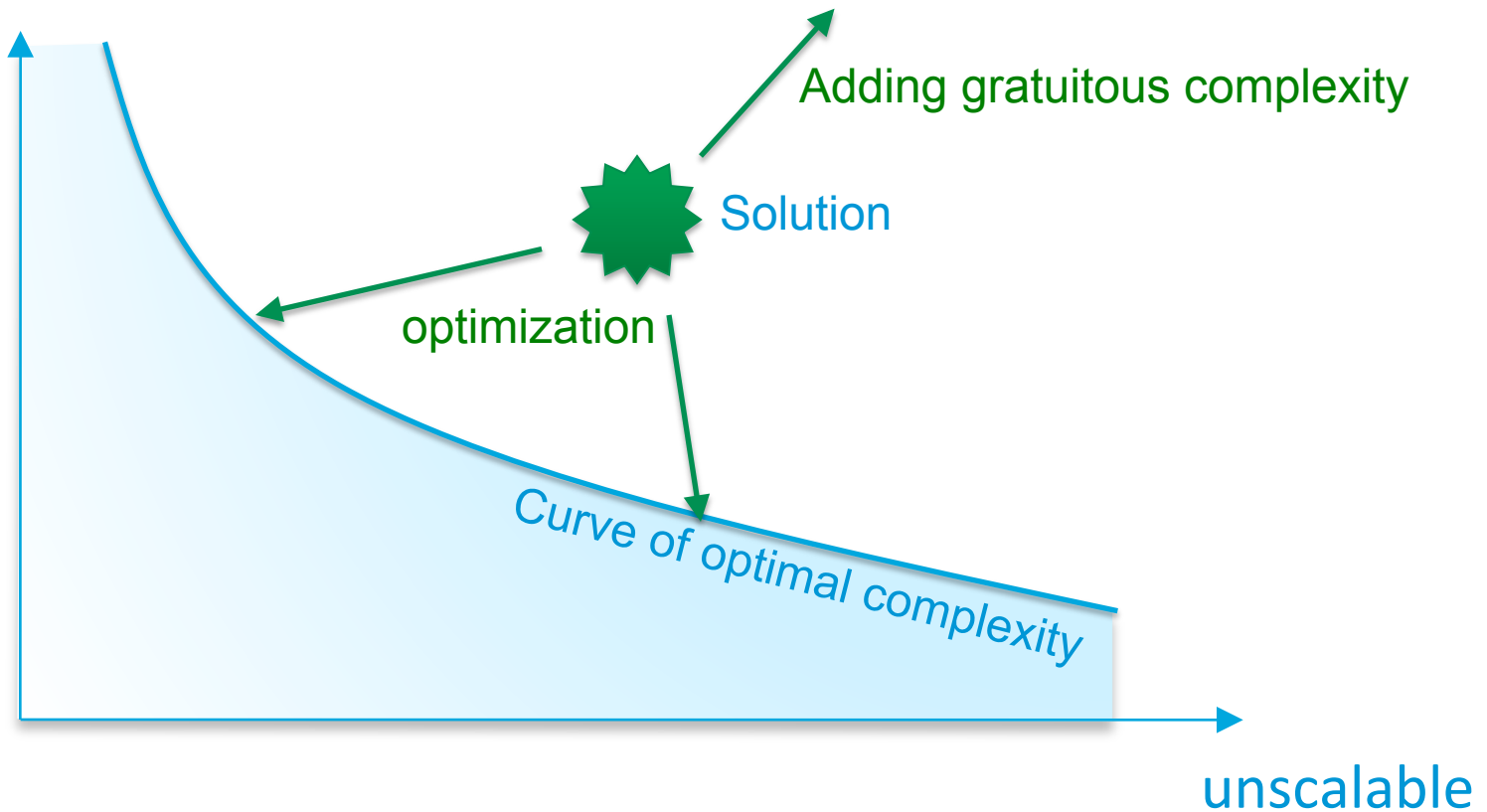
Source: John Doyle

Obvious Metrics

- Cost

  How much does the network cost to build (capex) and run (opex)

- Bandwidth / delay / jitter

  Traffic characteristics between two points (average, max, ...)

- Configuration complexity

  How hard to configure and maintain the configuration

- Susceptibility to Denial-of-Service

  How easy is it to attack the service

- Security (confidentiality / integrity)

  How easy is it to sniff / modify / insert the data flow

- Scalability

  To what size can I grow the network / service

Other Metrics

- Extensibility

  Can I use the network for other services in the future?

  Positive example: IP

  Negative example: Traditional telephony

- Ease of troubleshooting

  How hard is it to find and correct problems?

  Negative example: Manually configured IPsec overlay networks

  Positive example: Dynamic IPsec overlay networks

- Predictability

  If I change a parameter, what will happen?

  Negative example: Configuration

- Clean failure

  When a problem arises, does the root cause lead to deterministic failure

  Negative example: Coax Ethernet; browser certificate problems

  Positive example:

What's Next?

- Optimising a network on one axis should not worsen another axis

- Need metrics for each axis

- Comparability: Need to be able to make deterministic tradeoffs